



**MOTOROLA INC.**

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OCT - 7 1992

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

October 6, 1992

Ms. Donna Searcy  
Federal Communications Commission  
1919 M Street, N.W.  
Room 222  
Washington, D.C. 20554

RE: Dockets ET 92-100 GEN 90-314 ✓

Dear Ms. Searcy:

Representatives of Motorola met today with members of the Office of Engineering and Technology to discuss Narrowband PCS/Advanced Messaging. Two copies of written material presented are attached for the docket files.

Regards,

Stuart Overby  
Manager of Regulatory Programs

No. of Copies rec'd \_\_\_\_\_  
List A B C D E

0+1

MOTOROLA PAGING AND WIRELESS DATA GROUP

# ADVANCED MESSAGING SERVICES (AMS)

MM 10/3/92 Rev. 0

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

OCT - 7 1992

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# **AGENDA**

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- I. ENHANCED APPROACH TO AMS**
- II. SPECTRUM CONSERVATION THROUGH ASYMMETRY**
- III. SPECTRALLY EFFICIENT SYSTEM PROPOSAL**
- IV. BENEFITS OF MULTI-CHANNEL LICENSES**
- V. BENEFITS OF QUIET TALK-IN SPECTRUM**
- VI. RECOMMENDED BANDPLAN**

# **Advanced Messaging Service**

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## **• KEY SYSTEM ATTRIBUTES**

- INBOUND SIGNALING**
  - ACKS, REQUESTS, REGISTRATION, MESSAGES
- HIGH CAPACITY OUTBOUND MESSAGING**
  - WIDE-AREA SIMULCAST FOR:
    - BROADCAST MESSAGES (1-N)
    - LOCALIZATION (ADDRESS ONLY)
  - FREQUENCY RE-USE FOR INDIVIDUAL MESSAGING
    - ACK OF ADDRESS GIVES LOCATION
    - MESSAGE SENT IN LOCAL CELL ONLY
- COVERAGE EQUIVALENT TO PAGING**
- SMALL, LOW COST, LONG BATTERY LIFE  
SUBSCRIBER UNITS**

# **MOBILE DATA**

## **INBOUND / OUTBOUND SYMMETRY**

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- **MANY MOBILE DATA USES REQUIRE MORE OUTBOUND THAN INBOUND TRAFFIC CAPACITY**
- **IT IS POSSIBLE TO PURPOSELY BUILD AN ASYMMETRICAL DATA SYSTEM WHICH:**
  - **IS HIGHLY COST EFFECTIVE**
  - **MEETS THE TRAFFIC NEEDS OF MUCH OF THE MARKET**
  - **HAS SMALLER, LONGER BATTERY LIFE UNITS**
  - **IS SPECTRUM EFFICIENT**

**SUCH A SYSTEM REQUIRES LESS BANDWIDTH FOR INBOUND MESSAGES THAN FOR OUTBOUND MESSAGES**

# **PAGING**

## **ASYMMETRICAL MESSAGES**

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- **NATURAL DRIVERS TOWARD ASYMMETRY**
  - **INFOCAST BROADCAST SERVICES**
  - **REMOTE COMPUTER DATABASES**
  - **LIMITED ENTRY CAPABILITY OF SMALL DEVICES**
  
- **OTHER POSSIBLE DRIVERS TOWARD ASYMMETRY**
  - **FORMS OR CANNED MESSAGES AT PORTABLE DEVICE  
(RESIDENT OR RECEIVED VIA OUTBOUND RF)**
  - **MEMORY AT CENTRAL TERMINAL TO TRACK PORTABLE**
  - **WIRELINE ALTERNATIVE IN PORTABLE**
  - **PRICING AND TRANSFER TIME OF INBOUND RF**

# PAGING

## MOBILE DATA APPLICATIONS\* --- SYMMETRY

### APPLICATION

- MAIL
  - ORIGINATION
  - RECEPTION
  - FORWARDING
  - ANNOTATION W/ FORWARDING
- DATA INQUIRY/RESPONSE
- INFOCAST
- LINK SESSIONS
  - PORTABLE - COMPUTER
  - PEER-PEER
- FINDER (Call me at.., Who has a ...)
- ROUTE (Where is ...)
- MALL
  - SHOPPING (Tell me about your...)
  - PURCHASE (Buy (number) @ \$\_ )
- AGENT (Do this for me..Dispatch)
- SUBMIT (Take this...)

### SYMMETRY

- OUTBOUND WEIGHTED OVERALL
  - DEVICE LIMITED INBOUND
  - LONG OUTBOUND DOCUMENTS
  - INBOUND = ID+ADDRESSES ONLY
  - INBOUND = ANNOT+ID+ADDR ONLY
- MOSTLY LONG OUTBOUND
- LONG OUTBOUND ONLY
- OUTBOUND WEIGHTED OVERALL
  - MOSTLY LONG OUTBOUND
  - MOSTLY SHORT SYMMETRICAL
- OUTBOUND WEIGHTED
- SYMMETRICAL?
- OUTBOUND WEIGHTED OVERALL
  - MOSTLY OUTBOUND
  - SHORT INBOUND
- MOSTLY OUTBOUND
- MOSTLY INBOUND

\*From McLaughlin & Associates Inc - Mobile Communications Marketplace Pre-Convention Seminar 9/29/92

Prepared by Paging Division  
Bob Schwendeman 10/1/92

# PAGING

## TRAFFIC BALANCE ON "TAM" CHANNELS (W/O INFOCAST)

				TRAFFIC CONTRIBUTION (CHARACTERS/DAY)**	
MIX	TYPE	TRAFFIC	LENGTH	OUTBOUND	INBOUND
50%	NUMERIC PAGERS (NO ACK)	2.5/DAY	10 CHAR	12.50	0.00
25%	ALPHANUMERIC PAGERS (AUTO ACK ONLY)	3.0/DAY	80 CHAR	60.00	2.25
25%	E-MAIL / COMPUTER UNITS (AUTO AND USER ACK + INITIATION)				
	• E-MAIL PAGE RECEPTION	5.0/DAY	500 CHAR	625.00	15.00
	• 20% REPLIES	1.0/DAY	100 CHAR	0.75	25.00
	• FILE DOWNLOADS	1.0/DAY	10K CHAR	2500.00	30.75
	• FILE TRANSFER REQUESTS	1.0/DAY	50 CHAR	0.75	12.50
	• ALPHA PAGE INITIATION	1.0/DAY	80 CHAR	20.00	0.75

\* SUBMISSIONS &amp; E-MAIL ORIGINATION ASSUMED TO BE BY WIRELINE

\*\* ACKS ASSUMED TO BE 3 CHARACTERS LONG

TOTAL	3219.00	76.25
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INBOUND = 2.4% OUTBOUND

Prepared by Paging Division  
Bob Schwendeman 10/1/92



# **AMS = ENHANCED ONE-WAY MESSAGING**

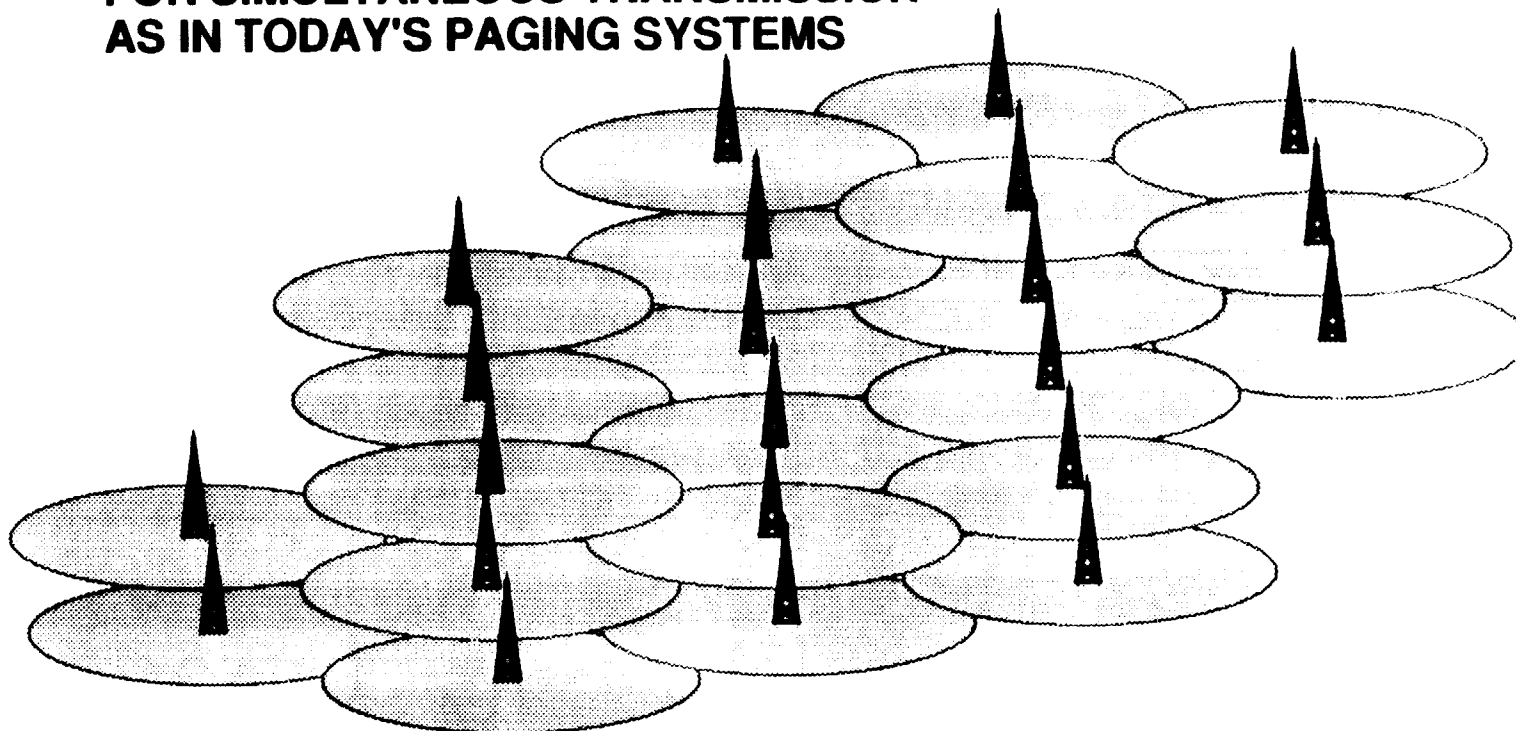
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## **• KEY SYSTEM ATTRIBUTES**

- INBOUND SIGNALING**
  - ACKS, REQUESTS, REGISTRATION, SHORT MESSAGES
- HIGH CAPACITY OUTBOUND MESSAGING**
  - WIDE-AREA SIMULCAST FOR:
    - BROADCAST MESSAGES (1-N)
    - LOCALIZATION (ADDRESS ONLY)
  - FREQUENCY RE-USE FOR INDIVIDUAL MESSAGING
    - ACK OF ADDRESS GIVES LOCATION
    - MESSAGE SENT IN LOCAL CELL ONLY
- COVERAGE EQUIVALENT TO PAGING**
- SMALL, LOW COST, LONG BATTERY LIFE  
SUBSCRIBER UNITS**

## **OUTBOUND MESSAGE - STEP 1 BROADCAST / LOCATION VIA SIMULCAST**

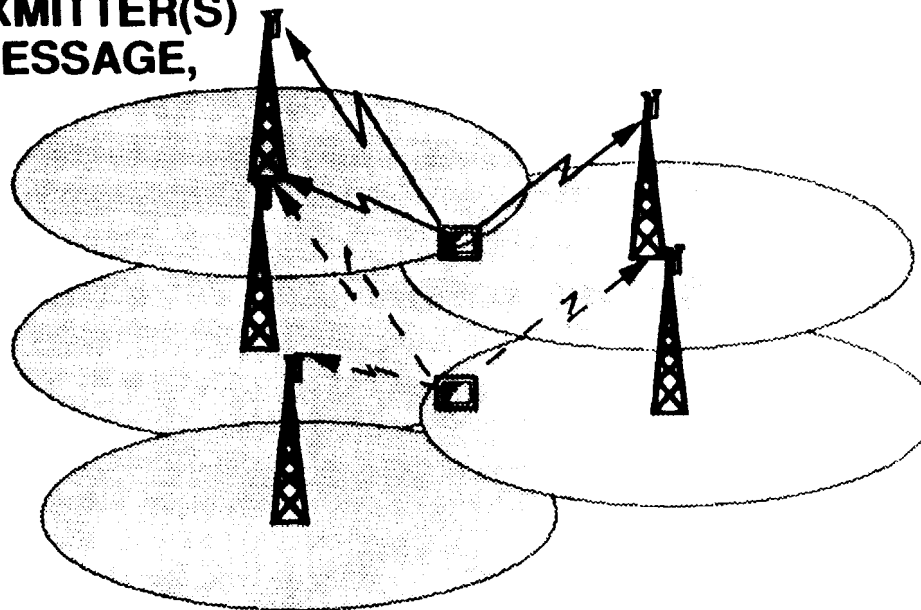
**MESSAGE SENT FROM CENTRAL CONTROLLER TO ALL SITES  
FOR SIMULTANEOUS TRANSMISSION  
AS IN TODAY'S PAGING SYSTEMS**



- USED FOR 1 TO N (BROADCAST) MESSAGES
- BROADCAST OF ADDRESS IS FIRST STEP IN DELIVERY OF MESSAGE TO SUBSCRIBER WHOSE LOCATION IS UNKNOWN

## OUTBOUND MESSAGE TO INDIVIDUAL - STEP 2 ACK OF ADDRESS

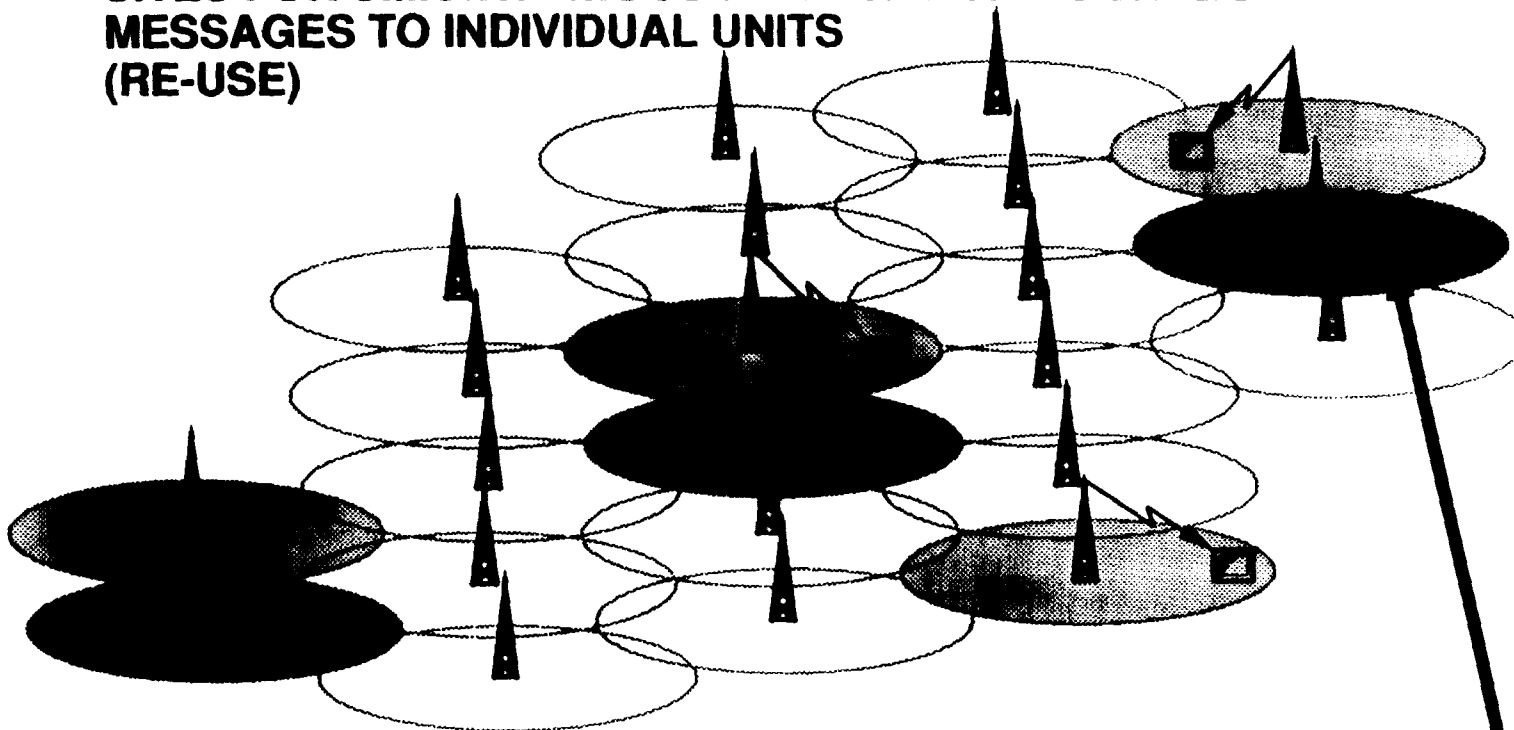
- UPON RECEIPT OF ADDRESS, UNIT RESPONDS IN UNIQUE (TIME/FREQ/CODE) CHANNEL
- MULTIPLE RECEIVE SITES LOG DATA AND SIGNAL STRENGTH
- CENTRAL CONTROLLER COLLECTS ACKS / SIGNAL STRENGTH, DETERMINES BEST XMITTER(S) FOR DELIVERY OF MESSAGE, AND SCHEDULES MESSAGE TRANSMISSION TO ACHIEVE MAXIMUM RE-USE



- MICRO AND MACRO DIVERSITY TO IMPROVE INBOUND RANGE
- NO RE-USE DURING ADDRESS ACK

## OUTBOUND MESSAGE TO INDIVIDUAL - STEP 3 NON-SIMULCAST DELIVERY WITH RE-USE

MESSAGES SENT FROM CENTRAL CONTROLLER TO INDIVIDUAL  
SITES FOR SIMULTANEOUS DELIVERY OF MULTIPLE  
MESSAGES TO INDIVIDUAL UNITS  
(RE-USE)



- TRANSMISSIONS RE-USE SAME CHANNEL IN CELLS SUFFICIENTLY SEPARATED
- ADDITIONAL CHANNELS WOULD INCREASE CAPACITY WITH SAME INFRASTRUCTURE

## **OUTBOUND MESSAGE TO INDIVIDUAL - SUMMARY**

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<b><u>STEP</u></b>	<b><u>ACTION</u></b>
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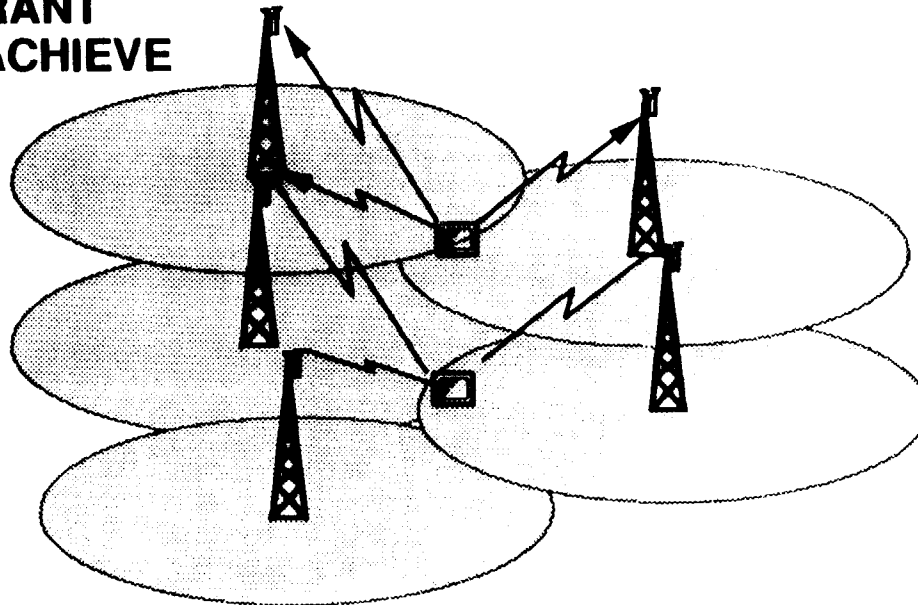
- |          |  |
|----------|--|
| <b>1</b> | <b>SIMULCAST ADDRESS</b>                               |
| <b>2</b> | <b>UNIT ACKS ADDRESS (NO RE-USE)</b>                   |
| <b>3</b> | <b>MESSAGE TRANSMITTED IN LOCAL AREA (WITH RE-USE)</b> |
| <b>4</b> | <b>UNIT ACKS MESSAGE DATA (WITH RE-USE)</b>            |
| <b>5</b> | <b>3 AND 4 REPEATED IF NECESSARY DUE TO ERRORS</b>     |

### **OPTIONAL**

- |          |                                       |
|----------|---------------------------------------|
| <b>6</b> | <b>USER INITIATED ACK OR RESPONSE</b> |
|----------|---------------------------------------|

## **INBOUND INITIATION - STEP 1 REGISTRATION, REQUEST, ASYNC RESPONSE, ETC.**

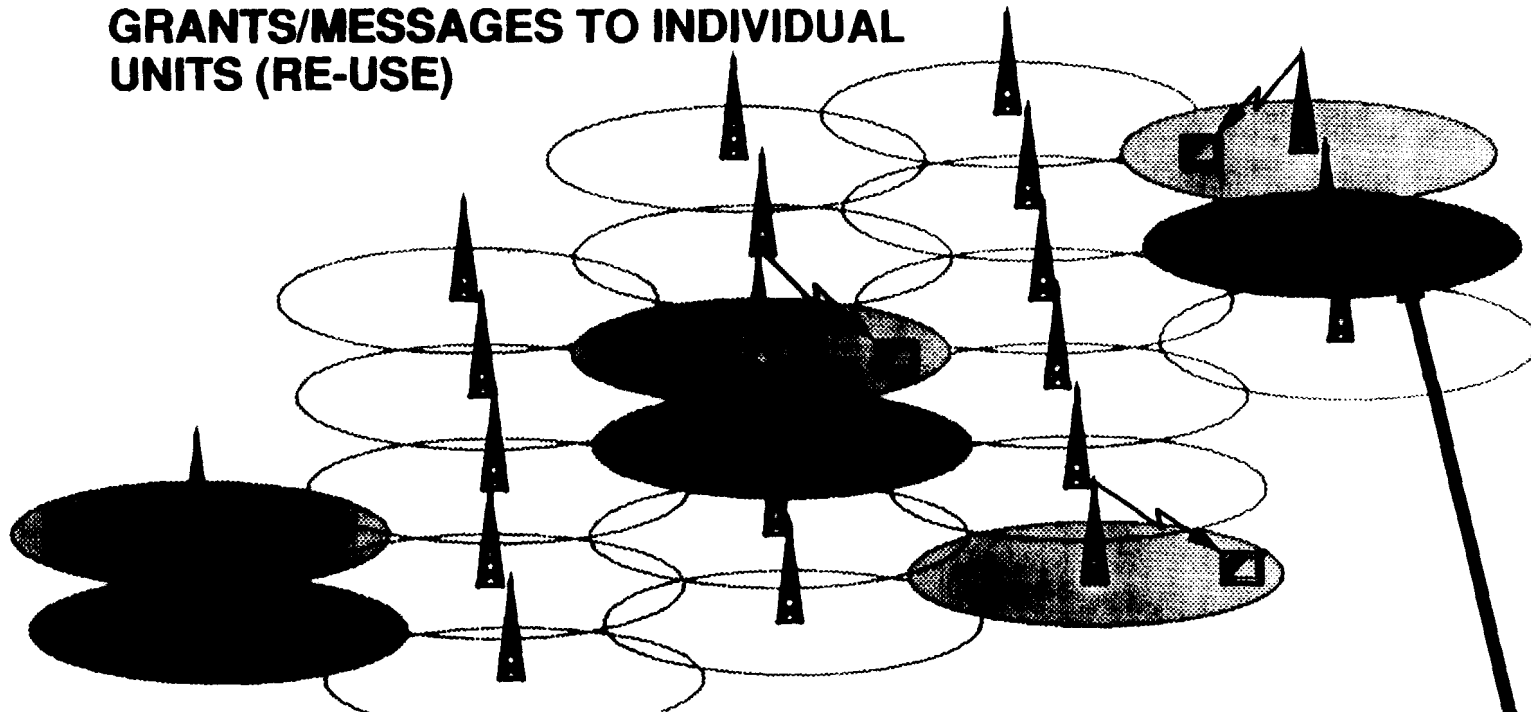
- UNIT TRANSMITS SHORT REQUEST FOR SERVICE
- MULTIPLE RECEIVE SITES LOG DATA AND SIGNAL STRENGTH
- CENTRAL CONTROLLER COLLECTS DATA / SIGNAL STRENGTH, DETERMINES BEST XMITTER(S) FOR DELIVERY OF GRANT, AND SCHEDULES GRANT TRANSMISSION TO ACHIEVE MAXIMUM RE-USE



- MICRO AND MACRO DIVERSITY TO IMPROVE INBOUND RANGE
- RE-USE AND/OR COLLISION MAY OCCUR - COLLISION RESOLVED BY RE-TRY

## INBOUND INITIATION - STEP 2 CHANNEL GRANT / ASSIGN

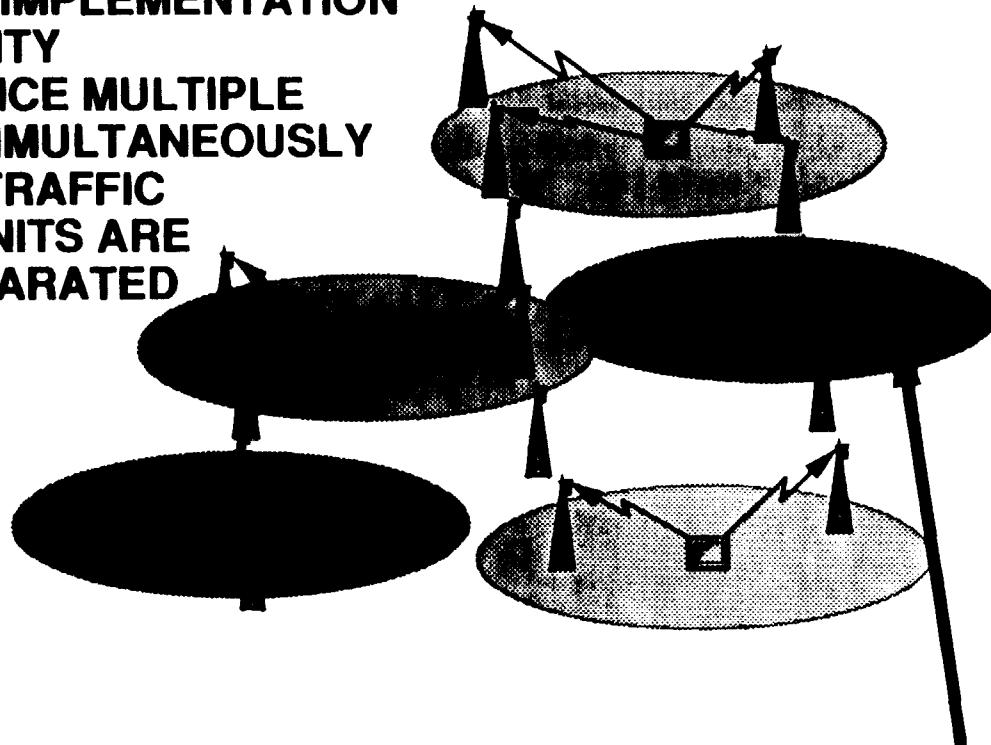
GRANTS SENT FROM CENTRAL CONTROLLER TO INDIVIDUAL SITES  
FOR SIMULTANEOUS DELIVERY OF MULTIPLE  
GRANTS/MESSAGES TO INDIVIDUAL  
UNITS (RE-USE)



- SAME AS STEP 3 FOR OUTBOUND MESSAGE
- TRANSMISSIONS RE-USE SAME CHANNEL IN CELLS SUFFICIENTLY SEPARATED
- ADDITIONAL CHANNELS WOULD INCREASE CAPACITY WITH SAME INFRASTRUCTURE

## **INBOUND INITIATION - STEP 3 INBOUND DATA TRANSMISSION**

- INBOUND DATA RECEIVED AT MULTIPLE SITES
- SITES RELAY DATA AND SIGNAL STRENGTH TO CENTRAL CONTROLLER FOR IMPLEMENTATION OF MACRO DIVERSITY
- RE-USE ACHIEVED SINCE MULTIPLE UNITS TRANSMIT SIMULTANEOUSLY IN AREAS WHERE TRAFFIC IS PENDING AND UNITS ARE SUFFICIENTLY SEPARATED



- ADDITIONAL CHANNELS WOULD INCREASE CAPACITY WITH SAME INFRASTRUCTURE



## **INBOUND INITIATION - SUMMARY**

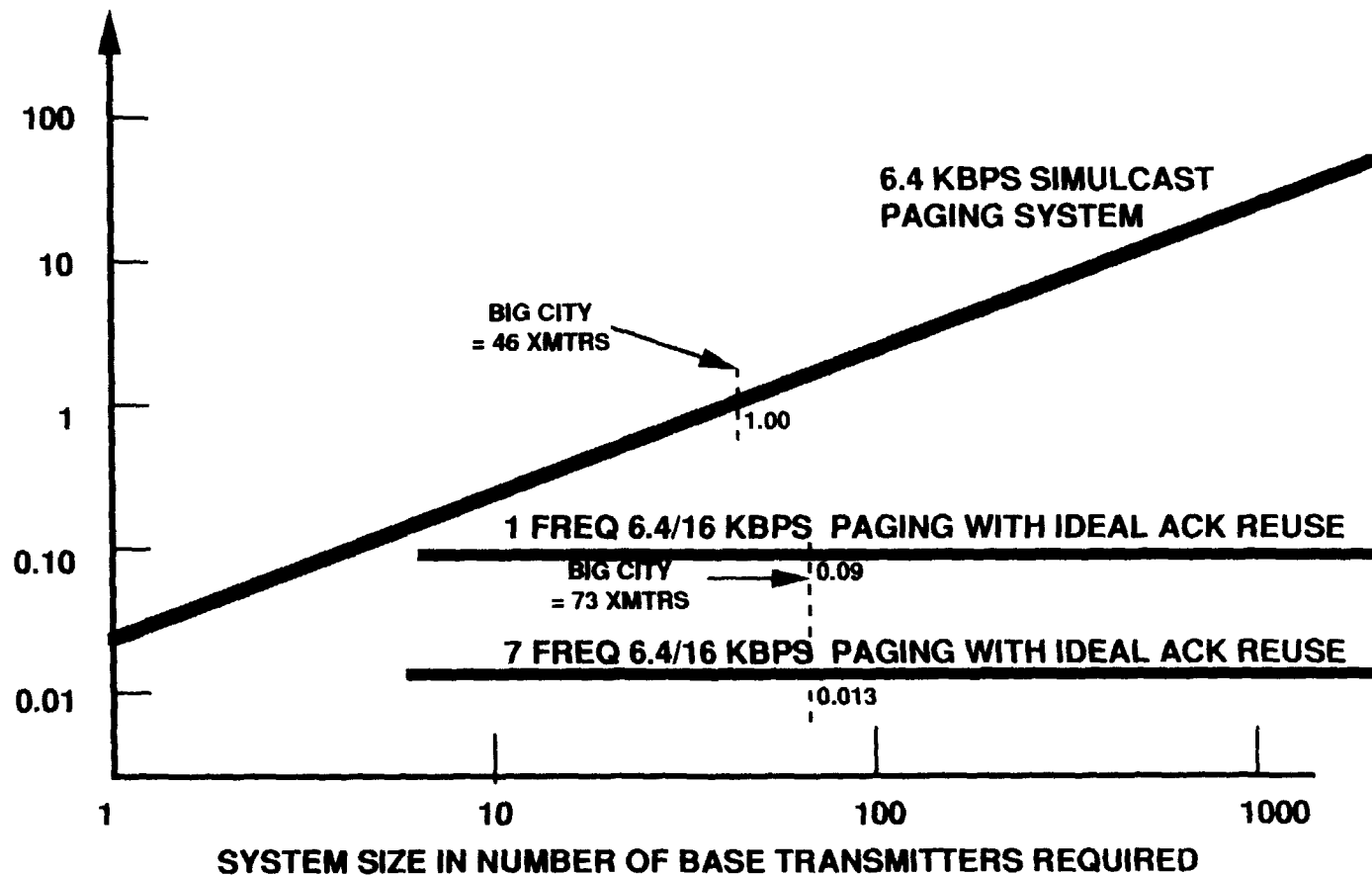
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<b><u>STEP</u></b>	<b><u>ACTION</u></b>
<b>1</b>	<b>INBOUND CHANNEL REQUEST (RE-USE)</b>
<b>2</b>	<b>OUTBOUND GRANT / ASSIGN (RE-USE)</b>
<b>3</b>	<b>INBOUND MESSAGE TRANSMISSION</b>
<b>4</b>	<b>OUTBOUND CONFIRMATION (RE-USE - LIKE 2)</b>
<b>5</b>	<b>3 AND 4 REPEATED IF NECESSARY DUE TO ERRORS</b>

# PAGING WITH ACK

## RF SYSTEM COST PER MILLION BITS VS SYSTEM SIZE

RELATIVE COST PER  
MILLION BITS DELIVERED



## **Band Plan Objectives**

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**To provide asymmetrical and symmetrical pairs to conserve spectrum.**

**To take advantage of the quiet 901-902 MHz "talk in" band for low cost system design.**

**To provide additional nationwide operators.**

**Pairing plan for all talk out channels.**

**To provide "talk in " channels to allow existing operators to upgrade.**

**To recognize that paging has progressed to regional operation. (no local allocations)**

# 901-902 MHZ FOR INBOUND

- **INBOUND CHANNELS NEED QUIET SPECTRUM**
  - **TWO-WAY USES PAIRED SPECTRUM FOR GOOD REASON**
  - **COST IMPACT IS EVEN WORSE WITH HIGH POWER PAGING**

INBOUND QUIET CHANNEL COST IMPACT			
FREQ. BAND	901-902	930-931	COST
# RCV SITES	40	400	360
RECURRING MONTHLY COSTS			
SITE RENTAL	\$8,000	\$80,000	\$72,000
LINE COSTS	\$6,000	\$60,000	\$54,000
TOTAL	\$14,000	\$140,000	\$126,000
*BASED UPON 20 DB DEGRADATION IN ACK RECEIVER SENSITIVITY DUE TO A SINGLE ADJACENT CHANNEL 1000W TRANSMITTER 1 MILE AWAY			

# STRAWMAN BAND PLAN M-50/150 kHz Channels.

+

TALK OUT

Regional  
Assemblies

National  
Symposium



940-941 MHz.

3, 150 kHz Channels  
11, 50 kHz Channel

TALK OUT

Regional  
Assemblies

National  
Symposium

MTEL



930-931 MHz.

20, 50 kHz. Channels

ACKNOWLEDGE/TALK IN

Regional  
Assemblies

National  
Symposium



901-902 MHz.

44, 12.5 kHz. Channels  
31 paired with talk out,  
13 available for existing  
systems.

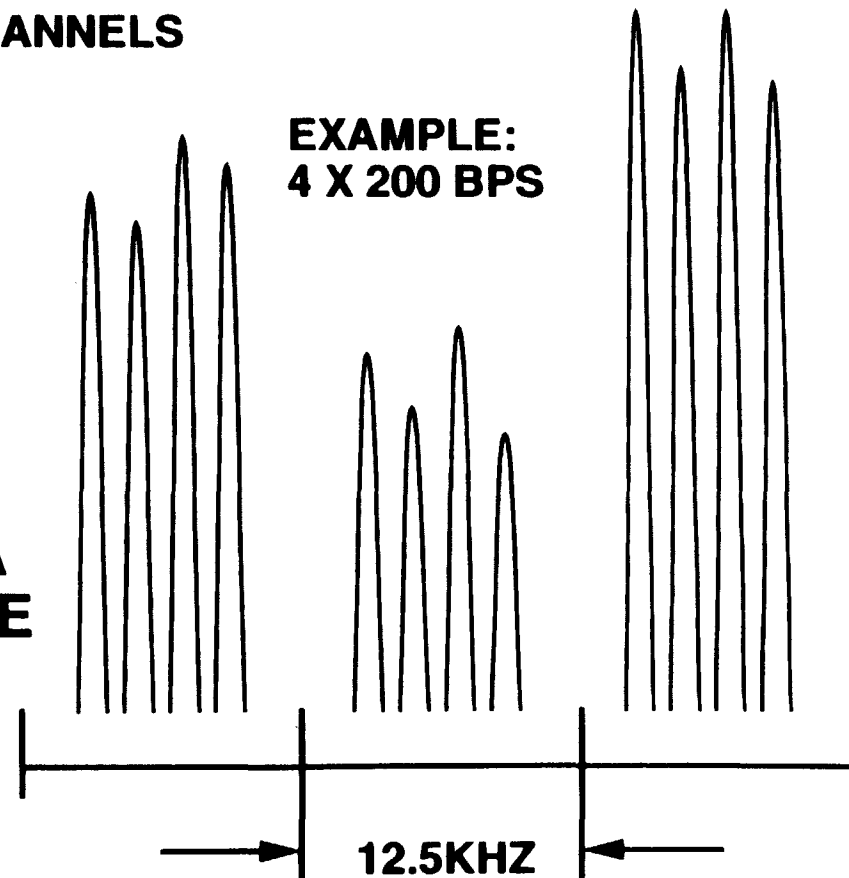
3, 150 kHz Channels

12.5 kHz  
Channels

All licensees at 930-931 automatically receive one of these channels. MTEL due to their pioneer preference status, may have a problem here.

# INBOUND CHANNEL ISSUES

- **LOW BIT RATE, NARROW CHANNELS  
MAXIMIZE RANGE**
- **MAXIMUM PACKING DENSITY  
IMPACTS SUBSCRIBER  
UNIT SIZE, COST, AND  
POWER CONSUMPTION**
- **REQUIRES PRECISE POWER  
CONTROL**
- **REQUIRES FREQUENCY  
STABILITY**
- **12.5 KHZ PROVIDES A  
GOOD COMPROMISE  
OF CAPACITY AND  
FLEXIBILITY vs  
IMPLEMENTATION  
COMPLEXITY**



# ASYMMETRIC SYSTEM IS AN ENABLER

## ASYMMETRIC SYSTEM

50 KHZ OUTBOUND

64 KBPS @1000W

128 KBPS @1000W

12.5 KHZ INBOUND

800 BPS @ 1W

SIMULCAST

NON-SIMULCAST

36 XMIT / 85 RCV

SITES FOR COVERAGE:

## SYMMETRIC SYSTEM

50 KHZ OUTBOUND

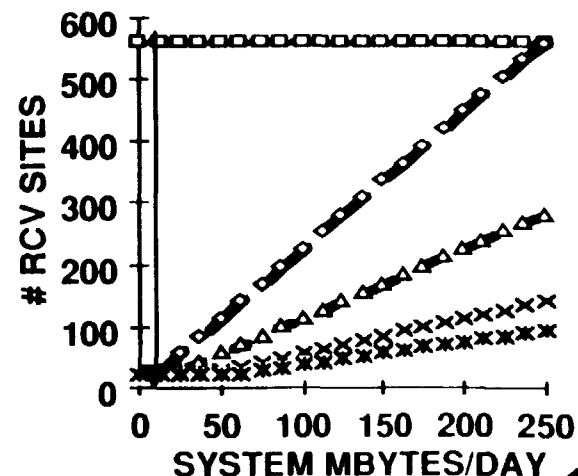
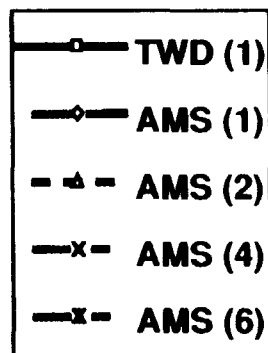
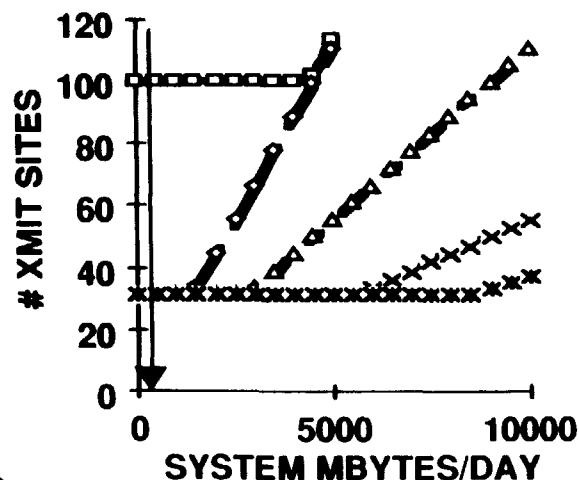
128 KBPS @100W

50 KHZ INBOUND

128 KBPS @1W

100 XMIT / 563 RCV

• LOW COST FOR INITIAL COVERAGE - SYSTEM GROWS TO MEET DEMAND



# **CONCLUSIONS**

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- **FOR MUCH OF ADVANCED MESSAGING,  
TALK-IN TRAFFIC << TALK-OUT TRAFFIC**
- **TALK-IN CAPABILITY ENABLES RE-USE ON OUTBOUND CHANNELS**
- **QUIET TALK-IN CHANNELS MINIMIZE INFRASTRUCTURE COST**
- **AN ASYMMETRICAL PORTION OF BANDPLAN:**
  - **MATCHES INBOUND SPECTRUM TO CAPACITY REQUIRED,  
LEAVING MORE SPECTRUM FOR OUTBOUND CHANNELS**
  - **ENABLES PAIRING (RE-USE) ON MORE OUTBOUND CHANNELS**
- **A SYMMETRICAL PORTION OF THE BANDPLAN WITH WIDE  
BANDWIDTH ALLOWS HIGH SPEED SIGNALLING**
- **MULTI-CHANNEL LICENSES IMPROVE SYSTEM CAPACITY WITH  
MINIMAL INCREASE IN INFRASTRUCTURE, FOR LOWER COST**